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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/053,446
Filing Date: January 17, 2002
Appellant(s): VIRBULIS ET AL.

James Proscia
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 3/12/2007 appealing from the Office action mailed 8/8/2006.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is incorrect. A correct statement of the status of the claims is as follows:

This appeal involves claims 1, 2, and 14. Claim 17 is allowed.

(4) Status of Amendments After Final

No amendment after final has been filed.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is substantially correct. It is noted that claim 17 is allowed after consideration of the instant appeal brief.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is substantially correct. The changes are as follows:

WITHDRAWN REJECTIONS

The following grounds of rejection are not presented for review on appeal because they have been withdrawn by the examiner. The rejection of claim 17 under 35 U.S.C. § 103(a) as

being patentable over Iida et al (U.S. Patent No. 6,077,343) in view of Haida (German Patent No. DE 3701733 A1).

(7) Claims Appendix

A substantially correct copy of appealed claims 1, 2, 14 and 17 appears on page 1-2 of the Appendix to the appellant's brief. The minor errors are as follows: Claim 17 is presented, but is not on appeal because claim 17 is allowed.

(8) Evidence Relied Upon

6,077,343	Iida et al.	6-2000
DE 3701811 A1	Haida	8-1988
4,905,756	Lari et al.	3-1990
JP 61-029128	Morishita et al.	2-1986
6,284,384	Wilson et al.	9-2001

Haida et al. English Translation of DE 3701811 A1, Dec. 2005, pp 1-17

Patent Abstracts of Japan. English Abstract of JP 61-029128 (1986).

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claims 1 and 2 are rejected under 35 U.S.C. 103(a) as being unpatentable over Iida et al (US 6,077,343) in view of Haida (DE 3701811 A1), an English Translation (ET) has been provided.

In a method of forming a silicon single crystal, note entire reference, Iida et al teaches an apparatus for pulling a silicon single crystal according to the Czochralski method comprising a crucible **32**, an annular solid-liquid interface insulator **8**, an upper surrounding insulator **9**, and a radiant heat reflecting plate attached to the lower portion (col 10, ln 30-65; col 11, ln 20-45; and Fig 3), this insulator and reflecting plate meets applicant's heat shield above the crucible limitation. Iida et al also teaches applying a magnetic filed to the silicon melt in a vertical direction or in a like direction to suppress a convection of the melt to thereby stably grow a single crystal (col 10, ln 60 to col 11, ln 5). Iida et al also teaches growing crystals having a diameter of 8 to 16 inches (~200-400 mm) would possible (col 14, ln 35-40) and using a crucible with a diameter of 18 inches (~457.2 mm) (col 13, ln 1-10).

Iida et al does not teach using a traveling magnetic field.

In a method of growing single crystal silicon in a Czochralski process, note entire translation, Haida et al teaches using a downward moving traveling magnetic field is applied to prevent the rising thermal convection flow in the melt from reaching the walls of the pot (pg 8-9). Haida et al also teaches an intensity of 20-200 Gauss (2-20 mT), this clearly suggests applicant's intensity which is sufficient to attenuate low-frequency temperature fluctuations in the melt because 20-200 Gauss (2-20 mT) is within the range of 2-15 mT taught by applicant teach using 2-15, note page 10 of the instant specification.

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Iida et al by using an downwardly traveling magnetic field to prevent the rising thermal convection flow in the melt from reaching the walls of the pot, as taught by Haida.

Referring to claim 1, the combination of Iida et al and Haida et al ('811) teaches a magnetic field around the melt moving down the pot (ET pg 5) to prevent the rising thermal convection flow from decreasing the downward flow (ET pg 8). The combination of Iida et al and Haida et al also teaches a traveling wave is placed in the pot to produce a downward driving power (ET pg 9, ln 1-2), this clearly suggests applicant's applying a magnetic filed to establish a convection which is initially directed to a bottom of the crucible. Furthermore, the combination of Iida et al and Haida et al teaches applying a downward traveling magnetic wave in a range of 20-200 Gauss (2-20 mT) and applicant teaches a magnetic field intensity in the range of 2-15 mT, note page 10 of the instant specification; therefore the traveling magnetic field taught by Haida is expected to produce an initial downward convection because the intensity overlaps the range taught by applicant's to cause a downward convection. A similar magnetic field is expected to produce a similar effect, namely a convection which is initially directed downward.

Referring to claim 2, Iida et al teaches 13-16 ppma, which is greater than $5x10^{17}$ atoms/cm^3, note Wilson et al (US 6,284,384) which teaches a wafer prepared in a Czochralski process with an oxygen concentration of $5x10^{17}$ to about $9x10^{17}$ atoms/cm^3 is equivalent to 10-18 ppm (col 8, ln 60-67).

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Iida et al (US 6,077,343) in view of Haida (DE 3701811 A1), an English Translation (ET) has been provided, as applied to claims 1-2 above, and further in view of Lari et al.(US 4,905,756) or Morishita et al (JP 61-029128), an English Abstract has been provided.

The combination of Iida et al and Haida ('811) teaches all of the limitations of claim 14, except the traveling magnetic is due to three coils which are connected to a 3-phase power supply and the traveling magnetic field exerts a substantially vertically oriented force on the melt is generated by suitable selection of an order of connections; and the connections of the coils have a phase angle in an order of 0°-60°-120° or 0°-120°-240°. The combination of Iida et al and Haida ('811) teaches providing a traveling magnetic field but not the claimed means of producing the magnetic field.

In an apparatus for producing magnetic fields, note entire reference, Lari et al teaches a magnetic field traveling wave is produced with only two coil layers with current 180° out of phase and in the preferred embodiment, three coil layers 120° out of phase are used, this clearly suggests applicant's connections of the coils have a phase angle in an order of 0°-120°-240°. Lari et al also teaches an AC source supplies three-phase alternating current. Also, additional coil waves could de used to produce a traveling wave, for example four coils 90° out of phase. It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Iida et al and Haida ('811) with Lari et al's means of producing a traveling magnetic field because selection of a known material based on its suitability for its intended use is held to be obvious (MPEP 2144.07).

In an apparatus for providing a magnetic field, Morishita et al teaches a magnetic generator made of a coil **30**, which is formed of coils 31a, 31b 31c. And when a 3-phase AC current having 120° different positions are respectively flowed to the coils, a traveling magnetic field which moves in a prescribed direction is generated (Abstract), this clearly suggests applicant's connection of the coils have a phase angle in an order of 0°-120°-240°. It would have

been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Iida et al and Haida ('811) with Morishita et al's means of producing a traveling magnetic field because selection of a known material based on its suitability for its intended use is held to be obvious (MPEP 2144.07).

(10) Response to Argument

Withdrawn Rejections

Appellant's arguments, see page 5 of the appeal brief, filed 3/12/2007, with respect to the 35 U.S.C. § 103(a) rejection over Iida et al (US 6,077,343) in view of Haida et al (DE 3701733 A1) have been fully considered and are persuasive. The rejection of claim 17 has been withdrawn. The translation of DE 3701733 relied upon by the Examiner was incorrect, thus the rejection has been withdrawn.

Arguments directed to claims 1 and 2:

Appellant's argument that Iida et al does not teach a heat shield is noted but not found persuasive (pg 5 and 7 of the appeal brief). Appellant alleges that Examiner incorrectly equates the reflecting heat plate to the claimed heat shield, note page 5 of the appeal brief. The Examiner's position, as stated in the rejection, is the annular solid-liquid insulator **8**, an upper surrounding insulator **9** and the radiant heat reflecting plate attached to the lower portion meets applicant's heat shield limitation. Appellant limits Iida et al to only the reflecting heat plate, however the annular solid-liquid insulator **8** and the upper surrounding insulator **9** depicted in Figure 3 clearly suggests appellant's heat shield above the crucible because the insulators shields the growing crystal from the heaters.

In response to appellant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Iida et al is relied upon to teach pulling a silicon single crystal, the crucible diameter, the use of a heat shield and exposing the silicon melt to magnetic field. The Examiner admits that Iida et al does not teach using a traveling magnetic field. However, Haida (DE 3701811 A1) teaches a magnetic traveling wave to produce a downward driving power, note page 9, lines 1-3 of the English Translation. Haida teaches it is desirable to add the magnetic traveling wave to prevent the rising thermal convection flow from reaching the walls of the pot or decreasing the downward flow, thus keeping flow volume sufficiently large to balance the increasing melt produced from thermal convection, note page 8, second full paragraph.

Appellant also alleges that Haida fails to disclose a convection which is initially directed to a bottom of the crucible. Appellant's argument is noted, however the argument is not persuasive. Appellant alleges that the initial direction of convention depends on a number of factors such as temperature gradients, densities, positioning of heat sources, physical size constraints and the like; therefore the convection taught by Haida is not necessarily initially directed to the bottom of the crucible. Haida teaches applying a downward traveling magnetic field, which produces a downward driving power, and the magnetic traveling wave is applied to prevent decreasing the downward flow (page 9, lines 1-3 and page 8, the second full paragraph of the English Translation). Haida's teachings would clearly suggest a convection which is

initially directed to a bottom of the crucible because the magnetic field produces a downward driving power and the downward flow is not decreased.

Appellant's argument that the claimed oxygen levels are patentable is noted but is not found persuasive. Appellant alleges that the oxygen levels of 13-16 ppma taught by Iida et al are not achieved in a process with an applied magnetic filed as in the present invention. First, the argument is mere attorney argument which lacks evidence; therefore is not persuasive. Second, it is unclear how appellant can allege that the oxygen levels taught by Iida which overlap the oxygen levels taught by appellant cannot be achieved using the magnetic field used in the present invention, yet appellant can achieve such an oxygen concentration while applying the magnetic field. Appellant would seem to suggest that the instant invention would also be incapable of produce a crystal within the claimed oxygen concentration range. Finally, Iida et al teaches an oxygen concentration which overlaps the claimed range, thus meets the claimed limitation. Therefore, a person of ordinary skill in the art would be able to add oxygen to the process if necessary to obtain the claimed oxygen concentration.

Arguments direct to claim 14

Appellant's arguments regarding claim 14 are noted but are not persuasive. Appellant merely alleges that the same arguments apply to claim 14. The same arguments applied to claims 1 and 2 are applied to claim 14.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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